AMENDMENTS TO THE SPECIFICATION:

Please amend paragraph [0009] as follows:

According to one aspect of the present invention, there is provided a semiconductor optical amplifier comprising: an active layer containing quantum structures of any of quantum dots, quantum wires and quantum dashes, the active layer amplifying light propagating therein while current is injected therein; electrodes provided for a plurality of sections of the active layer sectionalized along a light propagation direction, the electrodes being able to inject different currents into the sections; and a power supply for supplying current to the electrodes in such a manner that a first current linear density is set to at least one section of the active layer and a second current linear density is set to at least another section, the first current linear density being lower than a current linear density at a cross point and the second current linear density being higher than the current linear density at the cross point, the cross point being a cross point between gain coefficient curves of at least two different transition wavelengths of the quantum structures, the curves being drawn in a graph showing a relation between a density of current injected into the active layer and a gain coefficient of the active layer.

Please amend paragraph [0011] as follows:

According to another aspect of the present invention, there is provided a semiconductor optical amplifier comprising: an active layer containing a quantum structure of any of quantum dots, quantum wires and quantum dashes, the active layer amplifying light propagating therein

while current is injected therein; electrodes provided for a plurality of sections of the active layer sectionalized along a light propagation direction, each section belonging to a group selected from at least two groups, and the electrodes injecting different currents into the sections; and a power supply for supplying current to the electrodes in such a manner that current is supplied at a same current linear density to the sections belonging to the same group and current is supplied at different current linear densities to the sections belonging to different groups.

Please amend paragraph [0012] as follows:

Sections at the same current linear density are disposed dispersively. The length of each section can therefore be made short. It is possible to prevent light in a specific wavelength range from being excessively amplified so that gain saturation can be suppressed.

Please amend paragraph [0013] as follows:

According to still another aspect of the present invention, there is provided a light amplification method comprising the steps of: (a) injecting current into a first region of an active layer containing quantum structures made of at least ones of quantum dots, quantum wires and quantum dashes, at a current linear density satisfying that a gain coefficient of the quantum structures at the longest transition wavelength of the quantum structures becomes larger than a gain coefficient at the second longest transition wavelength, and injecting current into a second region different from the first region at a current linear density satisfying that the gain coefficient

of the quantum structures at the longest transition wavelength becomes smaller than the gain coefficient at the second longest transition wavelength; and (b) amplifying a laser beam introduced into the active layer while the current is injected into the active layer.

Please amend paragraph [0019] as follows:

FIG. 4 is a graph showing the relation between a gain coefficient and a current <u>linear</u> density of a semiconductor optical amplifier.

Please amend paragraph [0035] as follows:

FIG. 13 shows the wavelength dependency of a modal gain coefficient of the active layer. The abscissa represents a wavelength in the unit of "nm" and the ordinate represents a modal gain coefficient in the unit of "cm^{-1}". Each numerical value appended to each curve shown in FIG. 13 represents a current <u>linear</u> density injected into the active layer. The current <u>linear</u> density means a current per unit length of the active layer. The modal gain coefficient is constant even if the width of the active layer changes, so long as the current per unit length is constant.

Please amend paragraph [0039] as follows:

As seen from FIG. 13, the modal gain coefficient varies widely at each channel. For example, at an injection current of 100 mA/mm and an amplifier length of 25 mm, the gain at the eighth channel is 28 dB and the gain at the second channel is 150 dB. If the gain of 28 dB is retained at the eighth channel, <u>a</u> low reflection film coating resistant to the second channel gain

of 150 dB is necessary. This is, however, difficult. Although the gains of the channels may be equalized by using gain equalizing filters, the attenuation amount for the channel having a large gain is required to be very large. This results in an expensive filter. In addition, power is wastefully consumed.

Please amend paragraph [0055] as follows:

FIG. 3A shows an example of the structure of the active layer 4. The active layer 4 has a barrier layer 41 made of undoped $In_{0.53}(Al_{0.5}Ga_{0.5})_{0.47}As$ and lattice-matched with the InP substrate, and a quantum dot layer 42 formed on the barrier layer 41 and made of $In_{0.1}Ga_{0.9}As$ having a smaller lattice constant and a narrower band gap than those of the barrier layer. The quantum dot layer 42 has a thickness of, e.g., one to six-atom layer. [[Since]] <u>Because</u> the quantum dot layer 42 is not lattice-matched with the underlying barrier layer 41, it is grown in the S-K mode and does not form a continuous and uniform film.

Please amend paragraph [0058] as follows:

[[Since]] <u>Because</u> the quantum dot layers 42, 44 and 46 have [[the]] <u>a</u> band gap narrower than that of the barrier layer, the conduction band structure is as shown in the right area of FIG. 3A. The uppermost and lowermost barrier layers may be made thicker than the intermediate barrier layer.

Please amend paragraph [0064] as follows:

FIG. 4 shows a current <u>linear</u> density dependency of a gain coefficient per unit length of the active layer 4. The abscissa represents a density of injection current into the active layer in the unit of "A/mm" and the ordinate represents a gain per unit length (gain coefficient) in the unit of "cm^{-1}".

Please amend paragraph [0066] as follows:

[[Since]] <u>Because</u> there are a plurality of electron and hole levels, there are a plurality of transition wavelengths of quantum dots. The longest transition wavelength corresponds to an energy difference between an electron ground level and a hole ground level. A transition wavelength associated with higher order levels is shorter than the transition wavelength associated with ground levels. Which pairs of an electron level and a hole level correspond to the second and third longest transition wavelengths is determined by the material, structure and the like of quantum dots and barrier layers.

Please amend paragraph [0069] as follows:

It can be seen that as the injection current is increased, the gain coefficient becomes large. However, how the gain coefficient changes is different among the first to third gain coefficients. At the point that the current <u>linear</u> density is J_1, the first gain coefficient curve "Gnd" crosses the second gain coefficient curve "2nd". In the region where the current <u>linear</u> density is lower than J_1, the first gain coefficient "Gnd" is larger than the second gain coefficient "2nd", whereas in the

region where the current linear density is higher than J_1, the second gain coefficient "2nd" is larger than the first gain coefficient "Gnd".

Please amend paragraph [0070] as follows:

At the point that the current linear density is J_2, the second gain coefficient curve "2nd" crosses the third gain coefficient curve "Up". In the region where the current linear density is lower than J_2, the second gain coefficient "2nd" is larger than the third gain coefficient "Up", whereas in the region where the current linear density is higher than J_2, the third gain coefficient "Up" is larger than the second gain coefficient "2nd".

Please amend paragraph [0074] as follows:

In the optical amplifier shown in FIG. 1, it is assumed that the current linear densities in the regions R1 and R3 are 0.00475 A/mm and the current linear density in the region R2 is 0.1 A/mm. Namely, the regions R1 and R3 correspond to the third region having the length L(3) and the region R2 corresponds to the first region having the length L(1). If the optical amplifier has a full length of about 25 mm, the total length of the regions R1 and R3 are about 14.5 mm and the length of the region R2 is about 10.4 mm. Although the total length of the regions R1 to R3 is not 25 mm because of omission of the second region, this difference can be absorbed by finely adjusting the total length of the optical amplifier or each region.

Please amend paragraph [0076] as follows:

It can be seen from the comparison between FIGS. 6 and 15 that the light intensity near at the wavelength of 1200 nm of the first embodiment shown in FIG. 6 is weaker than that shown in FIG. 15 and light amplification in this wavelength range is suppressed. This is because the lengths of the regions R1 and R3 having a high current <u>linear</u> density are shorter than those of FIG. 15 (in FIG. 15, current having the same current <u>linear</u> density as that in the regions R1 and R3 is injected into all the regions).

Please amend paragraph [0077] as follows:

It can be seen from the comparison between FIGS. 5 and 14 that a dark area near at the end faces of the first embodiment shown in FIG. 5 in the wavelength range from 1300 to 1400 nm is smaller than that shown in FIG. 14. In this dark area, a desired gain coefficient is not obtained because the gain is saturated, although the injected current <u>linear</u> density is high.

Please amend paragraph [0081] as follows:

In the embodiment described above, the current <u>linear</u> densities in the regions R1 and R3 are set to 0.1 A/mm and the current <u>linear</u> density in the region R2 is set to 0.00475 A/mm. One of these two current <u>linear</u> densities is lower than the current density at the cross point between the first and second gain coefficient curves "Gnd" and "2nd" shown in FIG. 4, whereas the other is higher than that at this cross point. Similarly, one of these current <u>linear</u> densities is lower than that at the cross point between the second and third gain coefficient curves "2nd" and "Up",

whereas the other is higher than that at this cross point.

Please amend paragraph [0082] as follows:

One of the current linear densities in two regions of the active layer is set lower than the current linear density at a cross point between two gain coefficient curves at two transition wavelengths, and the other is set higher than that at the cross point. If the gain coefficient at the first transition wavelength in one region of the active layer is high, the gain coefficient at the second transition wavelength in the other region is high. In this manner, it is possible to reduce a gain coefficient difference between two transition wavelengths.

Please amend paragraph [0085] as follows:

Current is injected from the power supply 16 at a current linear density of 0.1 A/mm in the regions R11, R13, R15, R17 and R19. Current is injected from the power supply 15 at a current linear density of 0.00475 A/mm in the regions R12, R14, R16 and R18.

Please amend paragraph [0087] as follows:

It can be seen from the comparison of FIG. 10 with FIG. 6 that the light intensity in the wavelength range from 1100 to 1200 nm is weak. In the second embodiment, [[since]] because each of the regions having a high current linear density (e.g., regions R11, R13, . . .) is short, the light intensity does not rise too high even if light in the wavelength range from 1100 to 1200 nm is amplified in the regions having the high current linear density. It is therefore possible to

prevent light in the wavelength range from 1100 to 1200 nm from being amplified excessively. If light in the wavelength range from 1100 to 1200 nm is amplified too much, gain saturation occurs.

Please amend paragraph [0092] as follows:

In the second embodiment, a plurality of regions (sections) with a first current linear density being set are disposed and a plurality of regions with a second current linear density being set are disposed. One region with the second current linear density being set is disposed between the two regions with the first current linear density being set. With this configuration, the length of one section is short so that excessive amplification of light in a particular wavelength range can be suppressed and gain saturation can be prevented.

Please amend paragraph [0093] as follows:

In the first and second embodiments, each of a plurality of regions (sections) sectionalizing the active layer belongs to one group selected from two groups and the current linear density in each section belonging to the same group is the same. Three or more groups of sections each having the same current linear density may be prepared to make each section of the active layer belong to one group selected from three or more groups.

Please amend paragraph [0094] as follows:

In this case, it is preferable to adopt the configuration that between two sections belonging

to the same group, one section per each of the other groups is disposed. If there are two groups with the same current linear density being set, one section belonging to one group and one section belonging to the other group are alternately disposed.

Please amend paragraph [0096] as follows:

In the above-described embodiments, it is assumed that the size of each quantum dot is approximately the same throughout the active layer. As shown in FIG. 17, the size of each quantum structure 42 such as a quantum dot may be changed along the light propagation direction. As the size of the quantum structure changes, the shape of a gain spectrum also changes so that the gain changes with a position in the active layer. Namely, advantageous effects similar to those of changing the current linear density described in the above embodiments can be obtained.